

Assessment of Thatch Grass Harvesting Model in Protected Areas and Its Role as an Additional Livelihood Option for Woman in North West Matabeleland, Zimbabwe

Ndlovu Mukululi^{1*}, Makumire Aleck², Simakani Agness¹, Jele Thulani¹, Madiri Hilary Tinaapi^{3,4}

¹Zimbabwe Parks and Wildlife Management Authority, Matetsi Safari Area, ZIMBABWE

²Zimbabwe Parks and Wildlife Management Authority, Kazuma Pan National Park, ZIMBABWE

³Zimbabwe Parks and Wildlife Management Authority, ZIMBABWE

⁴WWF Zimbabwe Number 10 Lanark Road Belgravia, Harare, ZIMBABWE

*Corresponding Author

DOI: <https://doi.org/10.30880/jsunr.2023.04.01.001>

Received 15 February 2023, Accepted: 15 June 2023, Available online 30 June 2023

Abstract: Thatch grass is a readily available ecosystem product that plays a direct economic and utilitarian benefit to woman in households surrounding the protected areas of Zimbabwe. The study describes the institutional arrangement in place for the exploitation and lesson highlights of thatch grass in the protected areas of Matetsi Safari Area and Kazuma pan national park in North West Matabeleland region. The arrangement for thatch grass harvesting is that only the women (young and elderly) are allowed to apply for thatch grass harvesting in protected areas for defined period of time usually two weeks. We used park registers of thatch grass harvesters to determine the number of women involved, thatch grass bundles harvested and villages involved. At total of 15 744 bundles of thatch grass were harvested in the year 2022. The total bundles that the woman took home were 10 962 while 4 784 were retained by the park or concession holders. On average, an individual woman collected 27 to 125 bundles. Each individual woman direct income from thatch grass harvesting ranged from US\$ 40 to US\$187 per harvesting season. The key lesson in the thatch grass arrangement is that woman can successfully be mainstreamed directly to benefit from protected areas without experiencing negative effects associated with resource access in protected such as wildlife poaching which might occur when men are involved. Further, coordinated thatch grass harvesting has less conflict with the trophy hunting experience and activities in the hunting areas. While some challenges have been experienced in the national park component, the challenges are partly due to the perceived regulations, purpose of national parks and the somewhat negative attitude of stakeholders operating in the park to use of natural resource by local communities. In order for the thatch grass harvesting to remain sustainable and compatible with activities in the protected area there ought to be planning, coordination, monitoring of harvesting activities and ongoing ecological monitoring of potential ecosystem impacts.

Keywords: Sustainability, use value, non-timber forest product, protected area

1. Introduction

Thatch grass is one of the many tropical ecosystem products of the savanna. Savanna features the coexistence of both trees and herbaceous plants occurring in over 20 countries in the seasonal tropics. Approximately 20% of the

world’s land surface is covered with savanna vegetation, which produces almost 30% of global net primary production. Savannas are therefore a key biome in terms of biodiversity and human livelihood [1]. Most of the protected areas in Africa are in tropical savanna and so are vast human settlements. Important ecosystem services of savanna include; important services in water production, wetland functioning, watershed protection, forage for fauna and avi-fauna, recreation and goods including thatch grass [2]. Despite this, the savanna biodiversity is threatened by many factors such as conversion of land for farming, wildfires, overgrazing and bush encroachment.

Thatch grass harvesting in protected areas (PAs) has been done for many decades across Africa with large national parks providing use value to communities [3]. Rural households are dependent on wild natural resources to come across the needs of current consumption [4], and for saleable exploitation of forest products and other natural resources [5], [6]. The potential of PAs to contribute to social, economic and environmental wellbeing of communities’ adjacent parks is well recognized [7], [8]. The notion that communities are more likely to support continued conservation efforts when they can benefit and extract value from a PA has been stressed many studies [9]. There is thus a growing recognition that apart from conserving biodiversity, PAs does perform several other functions, such as protecting watersheds and soils, shielding human communities from natural disasters, or even civil conflicts, and stimulating local and regional economies [10].

1.1 Classification of PA Resource Economic Value

Biodiversity is seen and valued through a diverse and wide range of actors therefore the meanings and values given to biodiversity can often have acute and multifaceted implications [11]. There are two broad ways in which communities benefit from and value PAs namely use (consumptive) and non-use value (non-consumptive). Communities derive use and non-use benefits from a range of ecosystem products from protected parks and forest. These resources are referred to as Non-timber Forest Products (NTFPs) which are defined as any resources or products that are collected from the forest ecosystem to be used at the household level or marketed, and some of them are deemed important for social, religious and cultural purposes [12]. The use value contribution of NTFPs to human improved livelihood is acknowledged, however, the lack of proper instruments and parameters of measuring actual benefits especially those related to intangible values such as existence, intrinsic, spiritual, regulation of different processes undermine the net benefits of PAs [13]. Protected areas across the developing world are increasingly seeking to incorporate the needs of local rural communities into their management decisions allowing them access products such as thatch grass [9].

The World Commission on Protected Areas (WCPA) of IUCN, in collaboration with the Economics Service Unit of IUCN [13], [14] described the framework for describing the Total Economic Value (TEC) of protected areas as shown with modification in the Figure 1 below. Thatch grass falls within the direct use value chain.

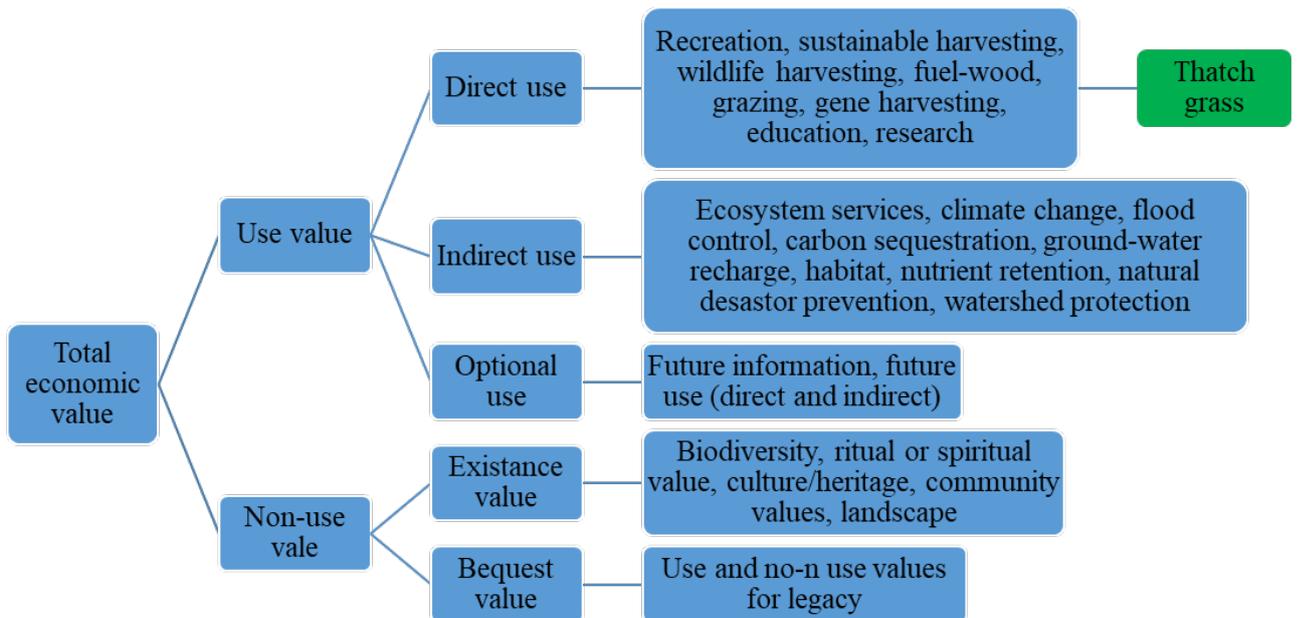


Fig. 1 - Classification of natural resources economic value adapted from Barbier et al. [14]

According to [15] over the years’ approaches and framing of conservation have changed from ‘Nature for itself’ characteristic of the period before 1970s where key ideas were species, wilderness and protected areas. From 1980 to 1990, the paradigms shifted to ‘Nature despite people’, dominated by ideas of extinction, threats and threatened species, habitat loss, pollution, and overexploitation of natural resources. At the beginning of the new millennium from

2000 to 2005 conservation framing was based on ‘Nature for people’, key ideas being ecosystems, ecosystem approach, ecosystem services and economic value. By the year 2010 the dominant theme had become, ‘People and nature’, the key ideas being environmental change, resilience, adaptability and socio-ecological systems [15]. The views on nature conservation are always evolving resulting in the multiple framings that are in use today. The key driver of this change is that the people’s dominance of ecosystems is changing conservation. This highlights that any PA that fails to recognize the needs of people living adjacent to them are bound to have more conservation issues.

The utilitarian and economic value of ecosystem goods such as thatch grass is important to communities in different ways. Thatch grass is derived from tall growing natural grass that is used for many domestic purposes such as for roofing-built structures, weaving baskets, garden and homestead enclosures, and agriculture plant nurseries among other uses. In Southern Africa, thatch grass is mainly derived from *Hyparrhenia* species.

The continued functioning of protected areas needs community support and provision of ecosystem services such as thatch grass is one step in achieving long term conservation relations [9]. More often benefits to local communities are underestimated due to lack of records, data and information. Further valuation of realized benefits is absent or not adequately captured by both PAs and communities to evaluate contribution of natural resource harvesting programs from PAs. Harvesting programs by communities in PAs require monitoring of off-take to ensure it satisfies the expectations and contribution to communities’ livelihood without compromising the goals of protected area. The harvesting of thatch grass is by no means a new phenomenon. This study looked at the role of thatch grass harvesting in selected focal protected area in Zimbabwe to document, add knowledge and provide a case for conservation benefits to local communities.

The use of natural products in protected areas by local communities has a long history, but few studies have explored both the socio-economic and ecological aspects of this use [16]. Determining the economic value associated with some of the services provided by forests can illuminate their contribution to the national economy, elevating the importance of conserving these resources for future generations and increase public appreciation of natural landscapes [17], [18]. The information can be used to influence policy around land management and be used by both government and civil society to help support natural resource decision making. The objective of the study was therefore to (1) ascertain how much thatch grass is being harvested from the study areas, (2) explore the potential benefits communities obtain from thatch grass harvesting, (3) identify challenges associated with the programme and make recommendations.

1.2 Thatch Grass Harvesting in Kazuma Pan National Park (KPNP) And Matetsi Safari Area (MSA) Protected Areas

Resource use programmes (RUPs) which facilitates sustainable harvesting of wild resources by communities is not a unique to the study areas but has been incorporated to address the needs of communities adjacent to PAs into their PAs management decisions and corporate social responsibility [9], [16]. Thatch grass harvesting is done in winter between June and July. The thatch grass harvesting model looked at in the study area is unique in that only woman are allowed to apply and harvest thatch grass in protected areas. Historically the collection of thatching grass and wild fruits are exclusive chores for women [19]. The local groups of women wishing to harvest thatch grass come together from the surrounding community and submit their applications to the Zimbabwe Parks Wildlife Management Authority (ZPWMA) station offices. The parks offices undertake its internal process of engaging with safari operators to establish areas of thatch grass harvesting which will not interfere with their hunting or photographic operations. When the areas have been identified, the applicants are given permission to cut thatch grass. The period of harvesting thatch grass may be up to 14 days so as to accommodate as many groups as possible of grass cutters depending on the number of applications. Thatch grass is harvested manually, with harvesters using a hand sickle to cut grass [9]. Upon entry into the park’s estate, a register is kept with details such as the full name, national identity number, village of residence. The groups of thatch grass harvesters are accompanied by armed rangers who provide supervision on where to cut the grass and protection services to grass cutters from potentially dangerous wildlife. At the end of the harvesting period, all the bundles gathered by each grass harvester are recorded. The Zimparks office retains one thatch grass bundle for every four bundles that are harvested in the park’s estate.

2. Methodology

2.1 Study Area

The study focuses on Kazuma Pan National Park -KPNP (313km²) and Matetsi Safari Area (MSA) Units 1 to 5 (1 888km²) in extent. The geophysical characteristics of KPNP and MSA are made up of the Sedimentary Kalahari Basin, Upper and Lower Karoo basalt that give rise to basalt and Kalahari sand soils. The basalt soils are more productive than the Kalahari sand soils as they retain more clay and mineral nutrients. The KPNP landscape includes a series of pan depressions which form vast grassland that are devoid of trees and the pans which are inundated for almost half the year. The MSA landscape is characterised by vast open vleis and wooded grassland. The annual rainfall ranges from 500 to above 700 mm and the temperatures in the dry season are as high as 42°C.

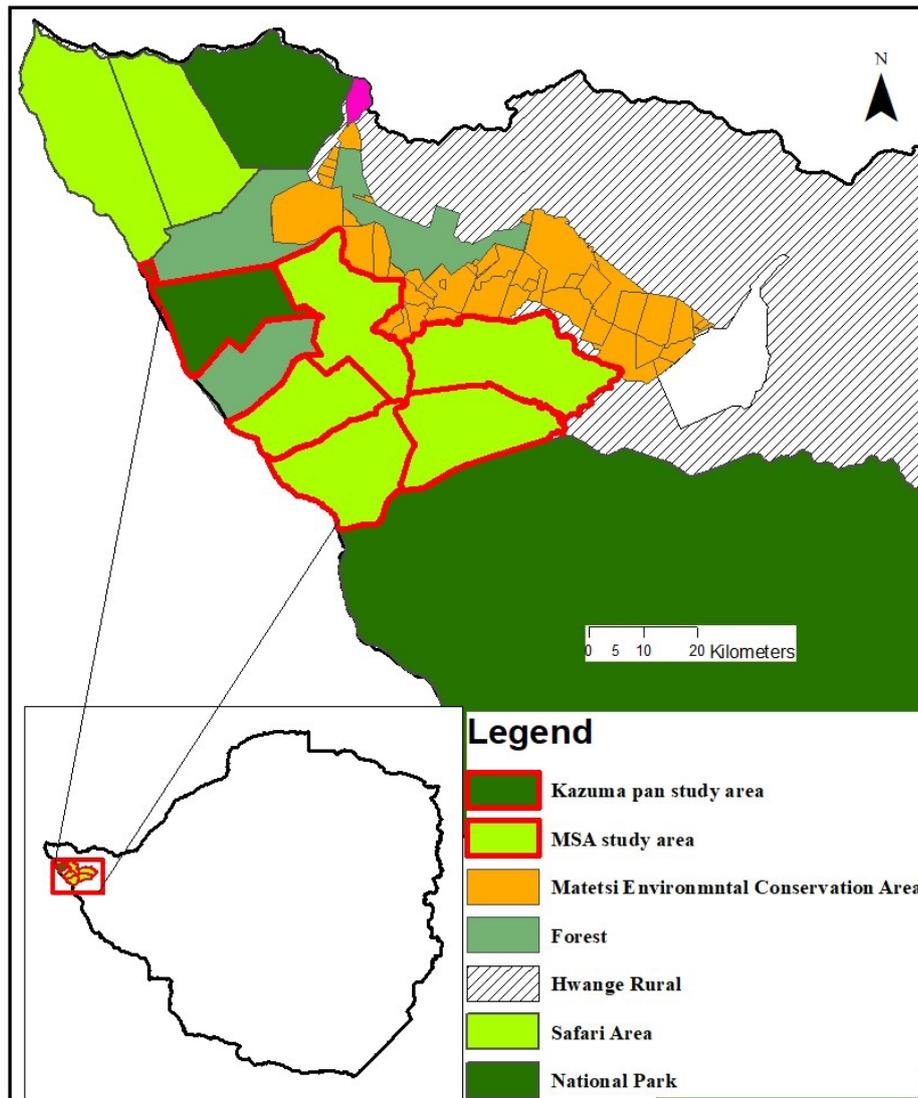


Fig 2 - Study area map

2.2 Data Collection

This study used secondary data obtained from KPNP and MSA grass harvesters register for the year 2022 because the grass thatching was consistently monitored and recorded. Although grass harvesting has been done for many years the records had information gaps and therefore could not be used for analysis. The grass harvesters register used in this study consisted of the individual name of grass cutter, his or her place of residence (village name), number of bundles retained by each person and the number of bundles retained by the park authorities. The selling price of a single bundle of thatch grass was obtained from thatch grass harvesters and they reported selling each bundle at US\$2. However, the grass cutters reported that they also incurred cost during the process of thatch grass harvesting and the major cost was transportation of thatch grass bundles from the park to their place of residence or market. The benefits of thatch grass harvesting to the study areas were mainly derived and documented from the author’s experiences after many years of managing the protected areas.

2.3 Data Analysis

We derived the total number of grass harvesters from the grass cutters register. We calculated the value of grass in US\$ from the quantity of bundles gathered by each grass cutter multiplied by local selling price of US\$2. General transport expenses for transportation of grass bundles were calculated at 25% of average market value of US\$2 per bundle. The total income of the thatch grass harvested by each individual was then calculated as total bundles retained by an individual multiply by average market price less transport expenses. The minimum, mean and maximum number

of grass bundles as well as the income per harvester were further calculated based on harvesting data using Statistical Package for Social Scientist IBM Version 20.

3. Results and Discussion

A total of 167 grass harvesters from 10 villages in Hwange District benefited from thatch grass harvesting in KPNP and MSA in 2022. The highest number of grass harvesters was recorded in KPNP (n = 109) compared to MSA (n = 58). The total grass bundles harvested from the two PAs were 15,744. The total value of thatch grass harvested and retained by thatch grass harvesters at selling price amounted to US\$21,924.00 while the direct income of grass after transport expenses amounted to US\$16,443.00. The direct total income from grass harvesting per individual ranged from US\$40 to US\$187.50.

Table 1 - Grass bundles harvested in respective source areas

Area	Total bundles retained by grass cutters	Retained by the Park
KPNP	6349	1904
MSA	4613	2878
Total	10962	4782

Table 2 - Grass bundles harvested per individual

Area	Minimum bundles	Mean bundles	Maximum bundles
KPNP	27	58	100
MSA	35	79	125

Table 3 - Individual income from grass harvesting

Area	Minimum Income (US\$)	Average income (US\$)	Maximum income (US\$)
KPNP	40.50	87.00	150.00
MSA	52.50	118.50	187.50

The main benefits of thatch grass harvesting are the removal of fuel load thereby contributing to suppression of late dry season wildfires, availability of thatch grass for roofing PA infrastructure and improved community relations.



Fig. 3 - Thatch grass bundles harvested in Kazuma Pan National Park and Matetsi Safari Area

3.1 Thatch Grass Yield and Economic Contribution

Products such as thatch grass can be traded commercially to generate cash for household use [19]. Thatch grass can also be harvested for construction of household structures such as house roofs. The income from selling thatch grass varies with areas and regions. In the area around Victoria Falls City and Matebeleland north in Zimbabwe, thatch grass collection has seen increased commercialisation due to increased development of thatched safari lodges in the

province [20]. This study recorded an income range of US\$40 to US\$187.50 per harvester per season. The reported selling price per bundle was reported to be US\$2 with direct income of US\$1.50 per bundle after removing transport cost. Although the price of a bundle of thatch grass varies in Zimbabwe on average \$1 have been realized from selling each bundle [21]. This is way less to estimated income of US\$350 to US\$750 reported in earlier studies conducted around Fuller Forest in the same landscape [20]. This variance in income is mainly due to many factors. This may be influenced by geographical location, land use type and level of resource protection. Fuller forest is located right adjacent to communal areas and thatch grass harvesting is amongst the major NTFP that is available for sustainable harvesting. Forest areas in the study landscape have played a critical role in providing thatch grass to communities for many years for instance 2,114 bundles were harvested in Gwai Forest between 1992 and 1994 while 2113 bundles were taken from Mbembesi between 1993-4 (Area South Forest Management Plans, 1994 Unpublished Document). However, the comparably low income estimated from this study may also be explained by the increase in the number of thatch grass harvesters. Income from thatch grass harvesting appears to be higher when a few harvesters are involved or if there is low yield of grass available for cutting which increases demand for thatch grass. The number of grass bundles harvested has also been reported to be dependent on rainfall with higher grass biomass being available in good rainy seasons. Despite this, thatch grass harvesting remains a part of community benefit even elsewhere in the Kavango Zambezi Transfrontier Conservation Area (KAZA TFCA). For example, an annual sales volume of 1.2 million bundles is estimated for the Kavango in Namibia, with grass reported being sold at between N\$7 and N\$10 per bundle by the local harvesters [22].

More often, policy makers and conservationist are seeking ways of mainstreaming woman to benefit from biodiversity conservation. This study shows that the NTFP such as thatch grass does contribute directly to empowering woman in areas adjacent protected areas in a sustainable way. The model being applied in the study area indicate that no issues of illegal activities post harvesting of grass are experienced when woman are involved than in cases were men take part. Research has shown that it is woman that harvest thatch grass in PAs to sell thus they see value in the resource. Elsewhere field observations indicate that thatch grass was the most used and sold NTFPs identified were thatch grasses followed by rope and wild-fruits in Mukwe area Kavango east region in Namibia [23]. Thatch grass is an easy resource that woman harvest in and outside protected areas.

The Goal 15 of the 2030 Agenda for Sustainable Development pertinently focuses on the need to “protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and biodiversity loss”. More specifically, Section 15.6 of Goal 15 stresses the need, “to further encourage and augment the benefits accrued as a result of ecosystem resource use, and which must be achieved in a manner that is equitable and just. In addition to this, Section 15.9 of Goal 15 also places emphasis on the need to, by the year 2020; assimilate biodiversity and ecosystem ideals into both local and national poverty alleviation strategies, as well as in development planning and practice” [24]. Involvement of communities through managed access to natural resources arguably goes a long way in making this a reality. The programme of thatch grass harvesting in many ways is a classic example that shows that protected areas do not simply restrict the use of resources, but rather that the resources within them can be made available to communities and can be harvested in a more sustainable manner [2]. The PAs in this study have huge potential to offer ecosystem goods and services while protecting and enhancing the survival of different forms of biodiversity therein. The study area is also vulnerable to habitat degradation due to repeated dry season fires which can be lessened when fuel load is reduced partly through thatch grass harvesting. Thatch grass is also essential for household use and a source of income to households of grass harvesters. Despite its contribution to sustaining livelihoods, NTFPs such as thatch grass tend to be overlooked by policy makers and have not been accorded the necessary attention in development planning and livelihood improvement programs [25], [26]. Thatch grass is arguably an important resource that has great potential in the broader wildlife economy if its value is considered beyond household use. It is therefore important that ways of value addition of thatch grass resource are also explored.

3.2 Benefits to Protected Areas

The programme of woman harvesting thatch grass has direct and indirect benefits to PAs. It increases conservation awareness to most vulnerable groups in society owing to the benefits they derive from the resource. Women are most influential group in society and spend most of their time with children and if they see benefits from resources obtained in PAs, they will teach their children thereby positively influencing their conservation mindset as future custodians of natural resources. The thatch grass harvesting programme has greatly contributed to improved park-community relations. The cases of thatch grass poaching become greatly reduced when the community is afforded the opportunity to access the resource in a formally coordinated way. In many cases, when poaching of thatch grass occurs, it is associated with the poaching for wildlife, honey and birds. Most PAs are not fenced on their boundaries and when there is no arrangement for communities to cut thatch grass, they can access the PA leading to incidences of illegal resource utilisation [27]. Grass harvesting also contributes to reduction of fuel load in the study areas. Although the thatch grass grows in open vlei, riverine and open woodland, the quality of the thatch grass is better in vlei areas which are open grassland with high grass biomass.

3.3 Challenges Associated with Thatch Grass Harvesting and Realizing Potentially Benefits

While the harvesting of thatch grass in protected areas is a good way for communities to realize the benefits from resources in PAs, there are also management and external challenges involved. Some conservation partners working in protected areas portray a negative attitude towards this practice. Concerns arise from legal definitions and use of protected areas. Some arguments advanced in this are that human presence in national parks disturbs wildlife and photographic activities. This stems mostly from the people having to share resources such as water with wildlife at water at natural and pumped water holes while in the park's estate. Questions have often been raised on what is the optimal number of grass cutters that can be accommodated at a particular time without compromising the routine wildlife and tourism activities. In fire prone areas, fire management measures such as early burning while preventing serious late dry season fires, they destroy the grass layer thus reducing thatch grass available for harvesting [29]. In the study area, thatch grass harvesting period coincides with the national pre-fire season that stretches from the first week of May to 31 July of each year, a period prescribed for land owners to put in place suppression measure to reduce veld fires. This is also at times present a challenge because thatch grass harvesters would be needing to cut grass while on the other hand concession holders or park management will be needing to do early burning activities in preparation for the dry season.

Despite being a potentially good source of income for woman living adjacent protected areas, the net benefit may not be fully realized due to cost associated with harvesting thatch grass such as transport cost to markets and their villages. In many instances the woman involved in thatch grass harvesting do not have means of transport to carry their grass after harvesting. Grass harvesters usually make arrangements with intended thatch grass buyers or middlemen who provide them with transport for a fee or they offset the transport cost with grass bundles. This entails that for maximum benefit to accrue to an individual, the grass harvester has to cut many bundles of thatch grass to carter for transport cost. This transport challenge has also been reported in South Africa where thatch grass beneficiaries are reported to sold a portion of their grass bundles to middlemen at a lower market price in exchange for transport services which has a net effect of reducing their income [24]. Despite, total incomes from NTFP trade being modest, they tend to be less so when expressed as a return to labor, with hourly returns generally surpassing minimum wage prescriptions [30]. In light of this, given that no sources of income may be readily available from sale of livestock and crops, thatch grass harvesting provides an income option to cater for some of the everyday basic needs.

4. Conclusion

The harvesting of thatch grass by woman is undoubtedly a way of mainstreaming woman into benefiting from biodiversity conservation an improving community-park relations. Thatch grass harvesting is a practice that may be undertaken in protected areas without compromising conservation activities provided that adequate monitoring and control protocols are in place. This study therefore advances the call for protected area managers to find ways and consider programs that can benefit adjacent communities from use of biodiversity resources in the protected areas.

The study recommends that woman involved in thatch grass harvesting need to explore ways to reduce cost of harvesting by getting rid of middlemen and getting into contractual arrangements with consumers in the market. Protected area managers should also strive to plan areas where local communities can access natural resources with minimum impact on wildlife species welfare and tourism activities. Determining harvesting thresholds and maximum number of gatherers to reduce negative impacts is critical. Adequate field monitoring of ecological impacts of thatch grass harvesting needs to be developed along with a framework for assessing its long-term sustainability. Understanding the quantity and spatial distribution of the thatch grass ecosystem services is important for ensuring the long-term provision of the product and ecosystem resilience to harvesting of natural resources to inform management planning by wildlife managers.

Acknowledgement

We would like to acknowledge the Zimbabwe Parks and Wildlife Management Authority Director General for the opportunity to carry out this study under the Scientific Services Terrestrial Unit. The contribution of Kazuma pan and Matetsi Safari Area offices for unveiling the data used in this study is much appreciated.

References

- [1] Hutely, L. B., & Setterfield, S.A. (2019). Ecosystems: Savanna. Reference Module in Earth Systems and Environmental Science In. B. Fath (Ed.) Encyclopedia of Ecology (2nd ed.) Elsevier: doi:<https://doi.org/10.1016/B978-0-12-409548-9.11148-0>.
- [2] Pelsler, A.J. (2022). Protected Areas as a Catalyst for Environmental Sustainability, Social Justice, and Human Development: Lessons from South Africa. In: Madhanagopal, D., Beer, C.T., Nikku, B.R., Pelsler, A.J. (eds) Environment, Climate, and Social Justice. Springer, Singapore. https://doi.org/10.1007/978-981-19-1987-9_11

- [3] Mutanga, C. N., Muboko, N., & Gandiwa, E. (2017). Protected area staff and local community viewpoints: A qualitative assessment of conservation relationships in Zimbabwe. *PLoS One*, 12(5), e0177153.
- [4] Neumann, R. P & Hirsch, E. (2000). Commercialisation of non-timber forest products: review and analysis of research. In: Bogor, Indonesia. Center for International Forestry Research, Rome: FAO.
- [5] Belcher, B. M & Schreckenberg, K. (2007). NTFP commercialization: a reality check. *Development Policy Review*, 25 (3), 355–37. doi: <https://doi.org/10.5897/JHF2013.0305>.
- [6] Fekadu, A., Soromessa, T. & Warkineh, D. B. (2019). Role of forest provisioning services to local livelihoods: based on relative forest income (RFI) approach in southwest Ethiopia coffee forest. *Environmental Systems Research*, 10(17). doi: <https://doi.org/10.1186/s40068-021-00223-7>.
- [7] Barany, M., Holding-Anyonge, C., Kayambazinthu, D. & Siteo, A. (2005). Firewood, food, and medicine: Interactions between forests, vulnerability and rural responses to HIV/AIDS. In *Proceedings from the IFPRI Conference: HIV/AIDS and Food and Nutrition Security*. Durban, South Africa, pp. 14-16.
- [8] Pienaar, E.F., Jarvis, S. L. & Larson, M. D. (2013). Creating direct incentives for wildlife conservation in community-based natural resource management programmes in Botswana, *Journal of Development Studies*, 49, 315–333.
- [9] Gordon, C. N. (2017). People and protected areas: natural resource harvesting as an approach to support rural communities surrounding Majete Wildlife Reserve, Southern Malawi: a case study. Doctoral dissertation, Stellenbosch: Stellenbosch University.
- [10] Chape, S., Spalding, M., & Jenkins, M. (2008). *The world's protected areas: status, values and prospects in the 21st century*. California: University of California Press.
- [11] Blaikie, P. & Jeanrenaud, S. (1997). *Biodiversity and human welfare*. In: *Social change and conservation*. Geneva: United Nations Research Institute for Social Development.
- [12] Pandey, A. K., Tripathi, Y. C., & Kumar, A. (2016). Non timber forest products (NTFPs) for sustained livelihood: Challenges and strategies. *Research Journal of Forestry*, 10(1), 1–7.
- [13] Adrian, P. (1998). *Economic values of protected areas: guidelines for protected area managers*. Best Practice Protected Area Guidelines Series 2.
- [14] Barbier, E. B., Acreman, M., & Knowler, D. (1997) *Economic valuation of wetlands: a guide for policy makers and planners*. Cardiff: Cardiff University
- [15] Mace, G. M. (2014). Whose conservation? *Science*. 345(6204), 1558–1560. doi: 10.1126/science.1254704.
- [16] Mudekwe, J. (2010). Forest products and the dynamics of harvested woody species: The impact of subsistence use of harvested woody species population in a protected forest reserve in western Zimbabwe. Germany : Lap LAMBET Academic Publishing GmbH & C. KG.
- [17] Martín-López, B., Iniesta-Arandia, I., García-Llorente, M., Palomo, I., Casado-Arzuaga, I., Amo, D. G. D., Gómez-Baggethum, E., Oteros-Razas, E., Palacios-Agundez, I., Willaarts, B., González, J. A. (2012). Uncovering ecosystem service bundles through social preferences.,” *PLoS One*, 7(6). doi: <https://doi.org/10.1371/journal.pone.0038970>.
- [18] Underwood, E, Hahn, B & Hollander, A (2020). Assessment of land use change and ecosystem services assessment of land use change, Zimbabwe. USDA Forest Service Assessment Report. California: USDA Forest Service.
- [19] Lepetu, J., Alavalapati, J., & Nair, P. K. (2009). Forest dependency and its implication for protected areas management: a case study from Kasane Forest Reserve, Botswana. *International Journal of Environmental Research*, 3(4), 525–536.
- [20] Mudekwe, J. (2017). Forest Resource Use Patterns in a Protected Forest Reserve in Western Zimbabwe-the Case of Fuller Protected Forest. *International Journal of Bio-resources and Stress Management*, 8(2), 346-359.
- [21] A. Mahlatini, P., Hove, A., Maguma, L. F., & Chemura, A. (2020). Using direct use values for economic valuation of wetland ecosystem services: A case of Songore wetland, Zimbabwe. *GeoJournal*, 85(1), 41–51.
- [22] Strohbach J. B & Walters, H. J. A. (2015). An overview of grass species used for thatching in the Zambezi , Kavango East and Kavango West Regions, Namibia. *DINTERIA*, 35, 13–42.
- [23] Kamwi, J. M., Endjala, J., & Siyambango, N. (2020). Dependency of rural communities on non-timber forest products in the dry lands of southern Africa: A case of Mukwe Constituency, Kavango East Region, Namibia. *Trees, Forest and People*, 2, 100022.
- [24] Kernan, A. L. M. (2016). An Assessment of the thatch harvesting programme at the Golden Gate Highlands National. PhD Dissertation, University of the Free State.
- [25] Ahenkan, A & Boon, E. (2010). Commercialisation of non-timber forest products in Ghana: processing, packaging and marketing. *Journal of Food Agriculture and Environment*, 8(2), 962-969.
- [26] Mabhare, V., Mujuru, L., & Gombe, J. (2015) The socio-economic contributions of non-timber forest products (NTFPs) in Muzarabani district, Zimbabwe. XIV World Forestry Congress, Durban, South Africa
- [27] Guerbois C & Fritz, H. (2017). Patterns and perceived sustainability of provisioning ecosystem services on the edge of a protected area in times of crisis. *Ecosystem Services*, 28, 196–206. doi: 10.1016/j.ecoser.2017.11.010.
- [28] Lowore, J. (2006). *Miombo woodlands and rural livelihoods in Malawi*. Jakarta: Center for International Forestry

Research.

- [29] Abbot, J. I. O. (1996). Rural subsistence and protected areas: Community use of the Miombo woodlands of Lake Malawi National Park. United Kingdom: University of London, University College London
- [30] Mahonya, S., Shackleton M. C. & Schreckernberg, K. (2019). Non-timber Forest Product Use and Market Chains Along a Deforestation Gradient in Southwest Malawi. *Frontiers in Forest and Global Change*, 2, 71. doi: doi: 10.3389/ffgc.2019.00071.